A freak phenomenon in the realm of impact factor

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The impact factor of *Acta Crystallographica Section A* jumped from 2.051 in 2008 to 49.926 in 2009. It may be noted that in 2009 this journal had the highest impact factor among all the journals indexed in *Journal Citation Reports*. Even in 2010, the journal ranked second with impact factor 54.333[1,2]. The rise in the impact factor of the journal was attributed to a single article entitled 'A short history of SHELX' by George Sheldrick[3].

This type of phenomenon is but rare and the journal can have very high impact factors in normal cases only for two years, and not beyond that. Let us mathematically explain the phenomenon.

The impact factor of a journal can be expressed with the formula –

$$IF_{(J)} = \frac{C_1 + C_2}{S_1 + S_2}$$

Where:

$IF_{(J)}$ = Impact factor of the journal J for the year Y

C_1 = Number of citations received by S_1 source items in the year Y

C_2 = Number of citations received by S_2 source items in the Y

S_1 = Number of source items published in the journal J in year Y - 1

S_2 = Number of source items published in the journal J in year Y -2

Putting the values of C_1, C_2, S_1, S_2 the impact factor of a journal can be easily computed.

Let us try to find out under what circumstances the impact factor of a journal can suddenly jump to a very high level. We shall consider three different cases.

Case 1 – Impact factor of J for the year 2009

S_1 = $a_1, a_2, \ldots\ldots a_{21}\ldots\ldots a_{50}$ source items belonging to year 2008. In all, there are 50 source items. Of these source items a_{21} has received 5000 citations, and the rest of the source items 100 citations in the year 2009.

S_2 = $b_1, b_2, \ldots\ldots \ldots\ldots b_{60}$ source items belonging to year 2007. In all there are 60 source items. In the year 2009, these source items have received 140 citations.

The 2009 impact factor of the journal J = (5100+140)/(50+60) = 47.6

Case 2 – Impact factor of J for the year 2010

In this case we are to consider the source items of 2008 and 2009. The source items of 2008 are S_1 i.e. $a_1, a_2, \ldots\ldots a_{21}\ldots\ldots a_{50}$. It may be noted that the source item a_{21} is present here also, and it will receive more citations in 2010 as the paper is two-year old and has come to the notice of many more researchers. Suppose, a_{21} receives 6000 citations in 2010, and others items receive 200 citations. Then, the total number of citations received by S_1 in 2010 will be 6200 citations.

S_3 = $c_1, c_2, \ldots\ldots \ldots\ldots c_{55}$ source items belonging to year 2009. The source items total 55, and suppose they receive 120 citations.

The 2009 impact factor of the journal J = (6200 +120)/(50+55) = 60.2

Case 3 - Impact factor of J for the year 2011

For the computation of 2011 impact factor, the citations (which may be very high) received by the paper a_{21} will not be taken into account as it will not come within the bound of the formula. It is extremely unlikely that other items will receive such large number of citations. As a result the impact factor will come down sharply.

In such cases the less the number of source items, the more will be the impact factor. The large number of citations received by one or two articles of a high impact journal will not hike the impact factor of the journal that much.

Suppose, a journal publishes around 1,000 source items per year. On average each source item receives

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25 citations. The 2,000 source items of two consecutive years will receive around 50,000 citations and the impact factor of the journal will be 25. In case an article of this journal receives 5,000 citations, then the rise of the impact will be 27.5 indicating a small rise.

Conclusions

This type of phenomenon will be extremely uncommon in the realm of impact factor. A paper of very high citation generation potential published in a journal will significantly increase the impact factor of the journal. The high impact factor of the journal will exist for two successive years. In the second year the impact factor will be more, and in the third year the impact factor will significantly decline. It will never be easy to predict the type of paper (except review paper) that will have very high citation generation potential.

References

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